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SUMMARY

Volume I is the programmatic Draft Environmental Impact Statement required by the National Environmental Policy Act (NEPA) for any federal actions which may significantly affect the environment. This EIS analyzes, at a programmatic level, the environmental impacts of the alternatives that would be initiated by the U.S. Army Corps of Engineers and King County to restore fish and wildlife habitat within the Green/Duwamish River basin.

Volume II is the Draft Restoration Plan that includes an approach to evaluate projects and a list of proposed restoration projects.

Overview of Volume I – Environmental Impact Statement

Purpose and Need

The purpose and need statement for this Programmatic Draft NEPA/SEPA Environmental Impact Statement (DEIS) and Restoration Plan is to improve the overall health of the Green/Duwamish River basin ecosystem for fish and wildlife species by increasing the quantity, quality, diversity, and connectivity of available habitat.

The need for such improvement to the ecosystem was well established from years of study conducted by the U.S. Army Corps of Engineers (Corps), King County, the Port of Seattle, the Muckleshoot Indian Tribe Fisheries Department, the Washington State Department of Fish and Wildlife, and others.

The overall objective of this restoration project is to restore significant ecosystem function, structure, and dynamic processes that have been degraded within the river basin. To accomplish this objective, the following basin-wide restoration goals were identified:

- Improve the physical nature of existing degraded habitat.
- Improve existing ecosystem functions and values. This includes improving riverine processes where reasonable.
- Address important factors limiting habitat productivity.

The purpose of this programmatic EIS is to assess the Corps proposal to implement a basinwide restoration program in the Green/Duwamish River. The purposes of preparing a programmatic EIS are to expedite and provide a point of departure for future site-specific projects, and to facilitate the preparation of subsequent project-specific NEPA and SEPA documents through the use of "tiering" or "phasing." The origin of this restoration plan and EIS was an Ecosystem Restoration Study (ERS) conducted as a part of the Corps' Ecosytem Restoration Program.

Description of Study Area

The Green/Duwamish River Basin includes 483 square miles of King County, located in Water Resource Inventory Area 9 (WRIA 9) southeast of Seattle, Washington. The Green River originates in the Mt. Baker-Snoqualmie National Forest in the Cascade Mountains of southeastern King County, south of Stampede Pass, at an elevation of about 4,500 feet. The river flows northwest 90.5 miles to Elliott Bay.

Throughout its course, the Green River passes through the Howard A. Hanson Dam, at river mile (RM) 64.5, and the Tacoma Diversion Dam (RM 61.0). The river then descends through the 13-mile-long Green River Gorge, from RM 60.0 to RM 47.4. Between Flaming Geyser State Park (RM 44.0) and State Route 18 (RM 34.0), the river traverses farmlands, open space, and lands owned by King County. Near the old White River confluence, the river enters the broad and heavily urban lower Green River Valley. Levees become common on one side of the river in the middle Green River Valley at the City of Auburn (RM 31.0) and are found on both sides of the river from RM 26.0 where it is heavily channelized to the mouth.

Affected Environment

A description of the Affected Environment is presented in Section 3 of this EIS. This discussion provides a brief synopsis of the existing resources within the basin.

Geology and Soils

The Green River originates in the Cascade Range south of Stampede Pass at an elevation of about 4,500 feet and flows northwest 90.5 miles to Elliott Bay. The highest elevation in the basin is 5,750-foot Blowout Mountain on the Cascade divide. The Green/Duwamish River system flows through the North Cascades and the Puget Lowlands Ecoregions (geographic areas that are shaped by geologic processes and have distinctive climate, plant communities, and wildlife populations). The entire floor of the Green River Valley is composed of alluvium, which ranges in thickness from tens of feet in the upper end of the valley to probably over 120 feet in the lower end of the valley (Mullineaux 1970). The alluvium is composed of coarse channel deposits and finer overbank deposits. Channel deposits are predominantly gravel and sand that are transported as bedload and deposited in bars and on the channel bottom. A typical Green River bank thus consists of a coarse lower bank covered by a layer of finer overbank sediment.

In the middle Green River, soils are largely formed from alluvium. These floodplain soils are subject to frequent flooding, seasonal ponding, and a high water table. Generally, riverwash and alluvium are well drained except when flooded. The soils along the lower Green/Duwamish River are not well known because extensive filling and industrial development in this area have largely covered up the native delta soils.

Fluvial Geomorphology

The prominent natural processes shaping the river include flooding and flow alterations, sediment transport, side-channel and geomorphic surface formation, riparian succession, and LWD recruitment. The construction of the Tacoma Diversion Dam, Howard Hanson Dam (HHD), and numerous levees along the river have reduced the migration of the river within the middle and lower basins, affected sediment transport, and reduced inundation of a significant

portion of the historic floodplain. Overall, the river has been shortened by 10.4 miles from the estuary to the lower end of the Green River Gorge at RM 47. (Perkins 1993, Corps 1997a, 1997b). The construction of levees and revetments has also limited the river's ability to carve or flood side channels (Fuerstenberg et al. 1996).

Hazardous Waste

Potential for hazardous wastes to enter the Green/Duwamish River and consequent sediment contamination is of most concern in the lower river. Urban and industrial development within the lower Green/Duwamish River has resulted in numerous contaminant sources, including industrial discharges, combined sewer overflows, stormwater runoff and shipping-related sources (accidental spills, treated pilings) (Tetra Tech 1998). Sediment sampling in the lower Green/ Duwamish River has identified several contaminants of concern in sediments, including oil and grease, sulfides, pesticides, polychlorinated biphenyls (PCBs) and polyaromatic hydrocarbons (PAHs) (Corps 1995; Corps 2000).

Surface Water

The upper basin is the primary area of water supply for the City of Tacoma as a result of the Tacoma Diversion Dam constructed in 1911 at RM 61. The Tacoma Water Department currently is allowed to remove up to 113 cfs for water supply (Corps 1998b).

With the construction of HHD in 1963, sufficient storage was provided to control the Green/Duwamish River flows to bankfull (approximately 12,500 cfs) at the U.S. Geological Survey (USGS) flow gage at Auburn. The Corps operates the dam for flood control, catching runoff peaks and storing flood water in the reservoir before it floods the lower Green/Duwamish Basin. The dam provides flood protection up to the 500-year event. As a consequence, since 1963 there have been almost no discharges above the regulated high flow of 12,500 cfs at Auburn. Today there is very little difference between the 2-, 5-, 10-, 25-, and 50-year events downstream of the dam; all range between 11,000 to 12,500 cfs.

Groundwater

The Green/Duwamish Basin downstream from the Green River Gorge lies within the Southwest King County Groundwater Management Area. Natural recharge to the aquifer system is from precipitation infiltration, and infiltration from streams, lakes, and wetlands (Woodward et al. 1995). Modeled recharge is low in the lower basin (Woodward et al. 1995); this area has a large percentage of impervious surfaces and consequently more precipitation runs off as surface flow.

Water Quality

The majority of the Green River and its tributaries are designated as Class A waters. Class A waters can be used for water supply, stock watering, fish and wildlife habitat, and recreation. While the Green River maintains its high water quality rating, it also appears on Ecology's list of impaired waters. The mainstem of the river and many of its tributaries regularly exceed parameters for Class A waters. (Corps 1997a)

Fish Resources

Human manipulation of the natural river processes to control flooding in the basin has channelized the river, especially in the middle and lower basins; eliminated high flood flows; created uniform flows; reduced sediment supply; and reduced supply of LWD in the river.

In-stream fish habitats have been mapped in the middle Green River basin and measured according to the McCain's (1990) Fish Habitat Relationship (FHR) methodology (Fuerstenberg et al. 1996). The habitat inventory was performed by traveling upstream from State Route 18 (SR 18) at RM 33.8 to the State Route 169 (SR 169) crossing at RM 60.3. Fast-water (riffle, run, and glide) habitats make up 82 percent of all identified habitat types. Within the fast-water habitat types, riffles and glides account for 44 percent and 53 percent respectively of the fast-water area (Corps 1997a). The slow-water habitats are represented by a total of 39 pools that fall predominantly into three habitat types: comer, lateral scour, and main channel pools. These types make up approximately 85 percent of the pool habitats. The slow-water category accounts for 4 percent of all habitats. (Corps 1997a).

Large woody debris (LWD) is an important element of salmonid habitat. LWD influences salmon populations by accumulating areas of gravel suitable for spawning, slowing water flow, and producing cover and resting habitat for fish. Given the composition of the riparian zone in the Green River, the age of the trees, and the lack of frequent channel movement, the recruitment rate of debris to the river low. The volume of wood found in the channel is well below undisturbed streams.

Fish habitat in the lower basin is generally limited and significantly degraded by the armoring of the river banks and urban/industrial development. Blomquist's (1996) study of fish habitat did not inventory the lower basin in detail because it essentially found that no high-quality fish habitat existed.

Over 30 fish species have been documented in the Green/Duwamish River. These fish species include both resident and anadromous stocks. Resident fish may be present in the lower river and the upper river including the reservoir area. Anadromous stocks are limited to the river system below Tacoma Diversion Dam, except where they are stocked or released in the upper basin. (Corps 1997a). Central to the Green River ecosystem are the species of salmonids that inhabit the river and its tributaries. Eight species of salmonids occur in the basin: summer- and fall-run chinook, coho, chum, rainbow/steelhead, both resident and sea-run cutthroat, and native char. Pink salmon were once common in the mainstem river and several tributaries but very few have been reported there in many years. (Corps 1997a)

Between 1938 and 1942, chinook escapement was estimated at 55,197. By 1995, escapement had dropped to 10,300. Historical data show that in 1930, 80 percent of spawning occurred in the mainstem below Palmer and the remainder in Soos, Burns, and Newaukum Creeks. By 1995, 80 percent of spawning occurring in Soos Creek, 6 percent in Newaukum Creek, and the remainder in the mainstem.

Historically, bull trout were found in the thousands in the middle Green River when the White River was connected to the Green River (Grette and Salo 1986). Currently, the White River still

supports a bull trout population, however the White River is no longer connected to the Green/Duwamish River. Their historic occurrence in the upper Green River has not been verified.

Vegetation

Plant association groups that dominate the upper Green River basin are western hemlock or Douglas-fir with an understory of swordfern, salal, and Oregon grape. In higher elevations there are also significant components of Pacific silver fir, with an understory of Alaska huckleberry. Currently, the upper basin has a high level of disturbance, with 20 to 60 percent of the upper basin considered hydrologically disturbed. The few forested slopes in this region are dominated by Douglas-fir, western hemlock, and western red cedar. Deciduous trees dominate the area (e.g., black cottonwood, Oregon ash, red alder, and willow).

The lower basin, including the Duwamish Estuary, has been heavily developed for industrial and residential purposes. In the remnant intertidal areas, the marsh communities are dominated by Lyngby sedge, saltgrass, Baltic rush, brass buttons, and hardstem bulrush. On upland sites, the vegetation is dominated by weedy species such as Scot's broom, Himalayan blackberry, and tansy ragwort.

The 1996 King County study indicated that conifer tree vegetation has been virtually eliminated and replaced by pavement, deciduous trees, and shrubs in the middle and lower basins. The total vegetation acreage (i.e., deciduous, conifer, and mixed trees) now is 28 percent of the length of the river and 36 percent along the river's edge compared to almost 100 percent coverage in a presettlement state.

Wildlife

Habitat in the upper basin consists of coniferous forests in early to mid-seral stages and clearcut areas in various stages of regeneration from previous logging operations. Only about 10 percent of the original old-growth forest habitat in the upper basin remains. The upper basin is prime habitat for large mammals such as elk, mountain goat, black-tailed deer, mule deer, black bear, and cougar. Elk are most commonly seen in the scattered meadows of abandoned farms.

Bird diversity is high in the middle basin, and many small mammals (e.g., foxes, skunks, weasels, and squirrels) use the dense understories of some of the forested stands. Small streams and sloughs meander through the pasture and upland habitats, providing habitat for many species of insects and for amphibians including red-legged frogs, Pacific tree frogs, salamanders, and toads.

The lower basin and Duwamish Estuary are now heavily developed for industrial and residential purposes. The remaining riparian, wetland, and estuarine habitats in the lower basin are used by a variety of birds and small mammals.

The listed endangered and threatened species in the Green/Duwamish basin include the bald eagle, gray wolf, marbled murrelet, northern spotted owl, bull trout, and Canada lynx. The peregrine falcon was delisted from its former standing as an endangered species by the USFWS on August 25, 1999, and is no longer subject to the Endangered Species Act. There is also

designated critical habitat for marbled murrelet and spotted owl on Forest Service land in the upper watershed. Two species, the spotted frog and mardon skipper, are candidate species that may occur in the basin.

Air Quality

The project area is classified as an attainment area for all criteria pollutants except carbon monoxide(CO), ozone, and particulates (PM 10). For CO and ozone, the region is classified as a maintenance area, which is a provisional attainment status that must be maintained for several years before being reclassified as full attainment. There are three pockets of PM10 nonattainment areas in the region, including industrial areas in Seattle, Kent, and the Tacoma Tideflats (Ecology 1999).

Noise

Existing sound levels throughout the basin are highly variable depending on location. Sound levels range from relatively loud noises associated with urban and industrial activities on the Duwamish River in the lower basin to very quiet rural environments in the upper basin.

Land Use

The upper basin consists entirely of unincorporated land where the major land use is logging. No permanent settlements currently exist in this part of the basin, though the small towns of Lester, Nagrom, and Maywood once supported small populations as logging, mining, and railroad stops.

Much of the middle basin is unincorporated lands, though the basin does include all or portions of the incorporated cities of Algona, Auburn, Black Diamond, Covington, Des Moines, Enumclaw, Federal Way, Kent, Maple Valley, Normandy Park, Renton, SeaTac, and Tukwila. The incorporated areas are concentrated in the lower portion of the middle basin.

Almost the entire lower basin is included in the incorporated cities of Burien, SeaTac, Seattle, and Tukwila.

Recreation

The Green/Duwamish River Basin is a heavily used recreation area both for water sports and more passive activities, such as fishing, bird watching, and hiking. Federal, state, King County, and local municipalities are involved in improving a system of parks within the Green/Duwamish Basin. Existing facilities include numerous municipal parks, golf courses, picnic facilities, and the Interurban Trail along the levees of the Green River.

Visual Quality

The combination of mountainous terrain covered by coniferous forests and limited land use establishes the upper basin as one of the most scenic in the entire Green/Duwamish Basin. The visual quality of the middle basin varies with its diverse topography and human development. The lower basin includes the entire Duwamish River. The region is a wide, flat valley with little variation in topography. Because of flood protection provided by HHD, much of the agricultural land in the lower basin has been replaced by commercial and residential development.

Population

In 1994, population in the Green/Duwamish Basin was estimated at about 900,000. This included contributions from the following jurisdictions and designated areas: unincorporated King County; the cities of Algona, Auburn, Black Diamond, Burien, Covington, Des Moines, Enumclaw, Federal Way, Kent, Normandy Park, Renton, SeaTac, Seattle, and Tukwila; and the Muckleshoot Reservation (Corps 1995).

Minority groups represent approximately 20 percent of the ethnic makeup of King County in 1998 and less than 20 percent for the state in general. Asian and Pacific Islanders constitute the largest single ethnic minority group in the county. The state, and to a lesser degree the county, has an increasing population that considers themselves of an ethnic background other than "standard" classifications (U.S. Bureau of the Census 1999).

Economy, Employment, and Income

The manufacturing, financial, business and personal services, wholesale/retail trade, and government sectors represent approximately 88 percent of the jobs and earnings of the population of King County. The natural resource utilization (e.g., farming, forestry, fishing, and mining) and infrastructure (e.g., transportation, communication, and utilities) sectors represent only 12 percent of the jobs (Bureau of Economic Analysis 1995).

Public Services

The Green/Duwamish River Basin encompasses unincorporated and incorporated portions of King County. Municipal police departments provide protection for the communities within the basin. County fire protection districts provide fire protection in unincorporated rural areas. Municipal fire departments provide protection for the communities within the Green/Duwamish Basin. Emergency medical services within the Green/Duwamish Basin are provided by primary response ambulance units and area hospitals.

There are several public schools, colleges, and universities within the Green/Duwamish Basin. In addition, numerous private elementary and secondary schools, colleges, and universities exist within the basin.

Potable water is available to residents living in the Green/Duwamish Basin from a variety of sources including municipal water departments, public utility districts, public water districts, community water associations, individual well systems, and private water companies. Many of these agencies have their own water supply sources and distribution networks. Also, many of these agencies provide sewer service with connections to the King County Metro treatment facility in Renton.

Cultural Resources

The Green/Duwamish River Basin was previously occupied by ancestors of members of the Duwamish and Muckleshoot Tribes. The Tribes have an interest in preserving traditional values and cultural resources. A traditional cultural property is one that is eligible for inclusion in the NRHP because of its association with the cultural practices or beliefs of a living community. These properties are rooted in the community's history and important in maintaining the community's cultural identity. Particularly important are sacred landforms, ceremonial sites,

rock art, cairns, certain animal and plant resources, and locations prominent in mythology and tribal history. Also of importance are cemeteries and isolated internments. Any human remains discovered may be subject to provisions of the Native American Graves Protection and Repatriation Act. State laws that address archaeological sites and Native American burials include the Archaeological Sites and Resources Act (RCW 27.53) and the Indian Graves and Records Act (RCW 27.44).

Alternatives

Following is a summary of alternatives presented and evaluated in this EIS.

Alternative 1: No Action

The No Action Alternative consists of the continuation of a variety of restoration activities under existing regulations and tribal, agency, and non-governmental organization restoration programs. Current independent management of the river basin by various agencies would continue, implementing activities under existing policies.

The goals of this alternative are to continue the implementation of project-by-project restoration activities through the current agency-based programs and also to achieve Endangered Species Act (ESA) or ESA-linked WRIA planning. The goals and objectives for restoration would be tied to those defined for each separate agency program rather than to the overarching goals of the basin-based program. Additionally, under No Action, the geographic focus and how the restorations will be implemented will also be tied to the individual programs.

The No Action Alternative assumes that efforts to improve fish habitat conditions throughout the Green/Duwamish River Basin would continue, but as a program of individual projects with limited funding opportunities. Restorations that do occur would most likely be as a part of single-jurisdiction actions based on location and funding opportunities rather than on comprehensive resource need. Restoration aspects of No Action would include continued project-by-project restorations that would incrementally reduce barriers to fish passage, connect potential habitat and potential major spawning and rearing areas with the mainstem river, increase estuarine habitat, and increase streamside vegetation. The geographic focus of this alternative would continue to be scattered throughout the Green River Basin, in much the same way as past projects. This alternative would be implemented through the current ongoing agency/sponsor programs, funding sources and jurisdictions.

Alternative 2: Multi-Species Approach (Preferred Alternative)

The Preferred Alternative would be a program to restore ecological resources and processes that would benefit multiple fish, riparian, and riverine-associated wildlife species. This alternative would focus on implementing a balance of activities that would not be at the expense of maintaining or improving successful populations of other species. This approach assumes restoration of larger areas of aquatic environment and riparian corridors, and providing connections to existing productive habitat that might otherwise not occur under the No Action Alternative.

Implementing this approach would result in an increase in functional habitat for a group of species, thereby resulting in an increase in functional habitat of other species as part of a balanced natural ecosystem.

Under this alternative, the geographic focus will be at the basin level, with the intent to manage restoration based on the total resource need rather than through individual programs as would be the case under the No Action Alternative.

Examples of activities that might be conducted as part of Alternative 2 include:

- **Reducing barriers to fish passage:** This activity would include reconnecting old channels by removing or relocating levees and other barriers in the middle Green River from the gorge to Auburn Narrows and the lower mainstem to the mouth (RM 57 to 0), and replacing or improving culverts on tributaries to benefit a variety of salmonids.

- **Improving habitat forming processes:** This activity would include retaining or importing sediment into the middle Green River, especially between Metzler O'Grady Park and Auburn Narrows and importing large woody debris into the middle and lower Green River (RM 42 to 0), in side channels, and in tributaries.

- **Increasing channel diversity:** This activity would include improving the channel cross sections in all tributaries, but particularly in Smay, Sunday, Soos, Burns, and Newaukum Creeks; and the entire Green River. Channel diversity would also be improved by increasing tributary flows into the mainstem and implementing channel-forming flows in the middle and lower mainstem (RM 60 to 0).

- **Improving estuarine habitat:** Habitat would be increased by creating deltaic habitat in saltwater areas that would benefit a variety of species including epibenthic organisms and a variety of fish species and their prey.

- **Increasing streamside vegetation:** Streamside vegetation would be increased by planting along tributaries, especially the North Fork of the Green River, on Smay Creek, Sunday Creek; along side channels; and along the entire mainstem of the Green River.

This alternative would be implemented through the Green/Duwamish River Ecosystem Restoration Program administered jointly by the Corps of Engineers and King County.

Under this alternative, monitoring of restorations and restoration success would be accomplished from a basin (ecosystem) approach, utilizing the monitoring protocol and GIS database program developed as a part of the ERS.

Project Evaluation

Candidate projects have been identified and evaluated by the Ecosystem Restoration Study Team (ERST) using project evaluation criteria (rationale for selecting the locations and types of restorations). The ERST (consisting of a panel of biologists and other technical staff from the Corps, King County, the Muckleshoot Indian Tribe Fisheries Department, Washington State Department of Fish and Wildlife, U.S. Fish and Wildlife Service, and several of the basin cities)

used the project selection criteria to evaluate the effectiveness of projects submitted by agencies and organizations. A feasibility analysis of the top-rated projects was conducted after evaluation and ranking of projects. The feasibility analysis included biological considerations along with design, cost, permitting, access, and land purchase factors. The 50 candidate projects evaluated are described in the Restoration Plan (Volume II).

Three possible subalternatives for implementing the multi-species alternative include developing restoration projects that replicate natural processes with minimum future maintenance, implementing engineered projects, or an integrated approach that would include a combination of these methods. These subalternatives are as follows:

Subalternative 2A: Ecosystem/Habitat-Forming Method

The Ecosystem/Habitat-Forming Method emphasizes recreating natural forms and functions in the Green/Duwamish River Basin (rather than only specific, limited parts of the river). The intent would be to restore natural processes over a larger area of the basin so that critical habitat and water conditions more closely emulate those that existed prior to human disturbance. These activities would be implemented so that long-term maintenance or repeated reconstruction would be minimized.

Typical activities included under this subalternative would include:

- Eliminate barriers to fish passage, providing access to miles of habitat, restoring interaction with the mainstem river, and opening major spawning and rearing areas to the mainstem river.
- Increase channel diversity throughout the basin and reconnect critical habitat to the river.
- Establish areas of estuarine habitat that are needed to benefit a variety of organisms and species.
- Replant, improve, or expand riparian and vegetative buffers to benefit fish and wildlife.
- Construct habitat structures that provide complexity (e.g., both deep and shallow pools for adult and juvenile fish).
- Increase large woody debris quantities and recruitment to benefit a variety of salmonids in the river system.
- Replenish the sediment downstream of Howard Hanson Dam to alleviate one of the major habitat problems in the middle Green River.
- Channel-forming flows would be implemented on side channels, in addition to those portions of the basin described for Alternative 1.
- Increase or protect floodplain and wetlands on the entire mainstem of the Green River, and tributaries, especially Soos, Burns, and Newaukum Creeks.

- Protect or restore riparian zones on the tributaries, especially Soos, Burns, and Newaukum Creeks; the side channels; and on the middle and lower mainstem (RM 42 to 0).

Subalternative 2B: Engineered Design and Constructed Habitat Method

The Engineered Design and Constructed Habitat Method would be an engineered, structured restoration approach that emphasizes water quality improvements and artificial propagation. Under this subalternative, a more focused method would be implemented (vs. an ecosystem/ basin approach) that would determine what structures could be constructed to benefit a specific, smaller portion of the Green/Duwamish River.

For example, an off-channel slough would be constructed in a highly urban area where previous human channelization of the river would not allow this to redevelop through natural processes. Similarly, if a species is severely reduced in abundance from loss of critical habitat, engineered restoration in combination with a reintroduction of a viable population would result in species recovery in that area.

Typical activities under this subalternative would include:

- Identify areas where hardened surfaces would be removed to increase surface water filtration and groundwater infiltration.
- Construct artificial spawning channels, rather than natural channels, to increase the amount and quality of spawning habitat available.
- Construct habitat features in areas where historical habitat-forming processes have been disrupted.
- Construct nearshore habitat in Elliott Bay to provide more complex nearshore environment for salmonids, rockfish, and invertebrates.
- Improve fish passage by constructing more natural channels to replace existing concrete flumes.
- Construct habitat features in areas where historical habitat-forming processes have been disrupted.
- Construct artificial spawning channels by excavating new channels in the middle Green River, from the gorge to Auburn Narrows.
- Alter disrupted habitat features and habitat-forming processes by removing instream structures that have caused that disruption.

Subalternative 2C: Integrated Method

Under this subalternative, a combination of activities described under the Ecosystem/Habitat-Forming and Engineered Design subalternatives would be implemented. Areas of the basin would be studied to determine what combination of Ecosystem and Engineered habitat restoration and water flow methods would be implemented that would provide the most benefit to key species in that area, with the least environmental impacts.

Alternative 3: Single-Species Restoration (Chinook Salmon)

This alternative focuses on restoring fish habitat to benefit a single species, the threatened chinook salmon as identified by the National Marine Fisheries Service (NMFS) under the Endangered Species Act, rather than a multi-species restoration approach.

Over the past several decades, effort has been focused on improving specific plant and animal species populations and habitats under the Endangered Species Act (ESA). Recovery plans have been developed and implemented for such ESA-listed species such as the bald eagle, grizzly bear, northern spotted owl, and marbled murrelet. In March 1999, NMFS listed the chinook salmon as threatened. As a result, programs are currently underway to address the restoration of the species under ESA.

The single-species alternative is not meant to comply with all legal implications associated with recovery under the ESA, but rather addresses the actions that would be accomplished under a voluntary restoration effort focusing on (capital) habitat improvements that benefit chinook salmon. The program would not address all of the chinook recovery needs but would make a significant improvement over current conditions.

The goals of this alternative are to implement capital improvement projects that would assist in increasing chinook populations in the Green River Basin in a manner consistent with regulatory requirements. These capital improvements would focus on improving life cycle requirements for the salmon within the Green River Basin and Duwamish Estuary. Restoration activities would be designed to increase the critical spawning and rearing habitat for and the number and/or distribution of chinook salmon.

The geographic focus of this alternative would be for restorations within the primary chinook habitat -- along the mainstem and estuary, and associated side channels and large tributaries (Soos and Newaukem Creeks).

This alternative would be implemented through the Green/Duwamish River Ecosystem Restoration Program administered jointly by the Corps of Engineers and King County. The public, local, state, federal and tribal groups would be solicited to identify potential projects. A technical committee would use project selection criteria to evaluate projects submitted by the various agencies and groups.

Under this alternative, monitoring of restorations and restoration success would be accomplished from a basin (ecosystem) approach, and utilizing the monitoring protocol and GIS database program developed as a part of the ERS. The monitoring plan would be based on the program goals and objectives, chinook use at the project sites, overall chinook population trends in the

Green River Basin, and measurable improvements to chinook habitat components at the project sites.

This programmatic alternative would have three associated subalternatives: 3A Ecosystem/Habitat-Forming, 3B Engineered Design and Constructed Habitat, and 3C an Integrated Approach.

Subalternative 3A: Ecosystem/Habitat-Forming Method

This alternative would utilize the actual processes within the Green River Basin that form chinook habitat. Evaluation of geology, hydrology, sedimentation, and other processes would identify where the ecosystem approach would be used to improve habitat for chinook salmon.

Examples of projects under this alternative include:

- Reducing barriers to fish passage by reconnecting old channels, and removing or relocating levees and other barriers in the middle Green River from the gorge to Auburn Narrows and the lower mainstem to the mouth (RM 60 to 0).

- Increasing critical habitat by importing large-diameter gravels and cobble (1-inch to 6-inch diameter) into the middle Green River, especially between Metzler O'Grady Park and Auburn Narrows. This would also include importing and placing large woody debris to make deep pools in the middle and lower Green River (RM 42 to 0).

- Increasing streamside vegetation by planting along the entire mainstem of the Green River.

- Increasing or protecting floodplain and wetlands habitat on the entire mainstem of the Green River.

Subalternative 3B: Engineered Design and Constructed Habitat Method

When natural processes cannot achieve population levels or genetic integrity needed to maintain a stable population, surrogate actions would be pursued through engineering design and constructed habitat. Projects under this subalternative include hatcheries, artificial spawning channels, incubation ponds, and pumping of groundwater to augment flows. Examples include:

- Construct artificial spawning channels by excavating new channels in the middle Green River, from the gorge to Auburn Narrows. Large gravels and cobbles (1-inch to 6-inch diameter) would be placed in these channels.

- Construct hatcheries, if it can be demonstrated that they would increase the viability of key species.

- Alter disrupted habitat features and habitat-forming processes by removing in-stream structures within the mainstem that have caused that disruption.

Subalternative 3C: Integrated Method

Under this subalternative, a combination of activities described under the Ecosystem/Habitat-Forming and Engineered Design subalternatives would be implemented. Both scale and location of projects within the focus area would be evaluated. Areas of the basin would be studied to determine what combination of Ecosystem and Engineered habitat restoration and water flow methods would be implemented with the least environmental impacts and the most benefit to key species in that area.

Environmental Consequences

Geological Resources

Soils and stream morphology, both dynamic conditions in riverine systems, would be modified along the Green River as a result of implementation of restoration activities under all alternatives, including No Action. Under all alternatives (Alternatives 1, 2A, 2B, 2C, 3A, 3B, 3C) including No Action, short-term impacts to soils would occur during the construction phase, and to a far lesser extent over the long term from implementation of the restoration features. Construction activities would result in localized and temporary disturbance to soils at the construction sites, soil compaction, and removal or modification of coarse channel deposits and/or finer overbank alluvium.

Restoration activities for all alternatives (1, 2, 2A, 3A, and 3B) would result in beneficial changes in the geomorphic characteristics and distribution of alluvium throughout the Green River system. The restorations would result in conditions in portions of the river that would mimic more natural movement of channel alluvium and gravels than under existing conditions. The sedimentation processes will be incrementally improved over time by restoring predisturbance hydrologic regimes that facilitate natural sediment movement and sediment storage, and reducing bank erosion, thus decreasing sediment loads into aquatic systems.

Modifications to channel depth and profile will occur under all alternatives (Alternatives 1, 2A, 2C, 3A, and 3C) except 2B and 3B (engineered subalternatives). These changes would result from such restoration activities as removing and/or relocating levees, importing sediment (gravels, cobbles), improving channel cross-sections, and importing large woody debris (LWD).

Hazardous Materials

There is a potential for encountering hazardous materials at restoration sites, particularly in the lower basin. The potential for hazardous waste will be evaluated on a project-by-project basis. Land use practices at each restoration site will be examined to determine if there is a reason to believe that potential contamination exists. If the determination is made that there is a contamination potential, then the proper sampling intensity will be conducted to determine the type and extent of contaminants. Where appropriate, soil testing will occur and all applicable regulations shall be followed. If testing indicates that there are contaminants at the site, the site will be cleaned up in compliance with pertinent regulations. If the contamination is too severe, the project will be abandoned.

Impacts on stream morphology would be long term rather than construction-related. Main and side channel modifications, installation of in-channel structures (e.g., LWD), and importing gravel all represent activities that, in the long term, are designed to beneficially alter the morphology of the Green and Duwamish Rivers. These stream modifications are directed toward restoring the long-term function of aquatic and riparian ecosystems.

Surface Water

During construction, short-term modifications to surface water patterns (rerouting) would be required during installation of restoration features such as reconnecting channels, removing culverts, and installing woody debris. Such modifications would routinely be accomplished using established construction procedures such as temporarily installing half or full culverts to carry surface flows around active construction areas.

Patterns of surface water movement would be changed by removing or reducing barriers to fish passage, importing gravel and LWD, modifying channel profiles (Alternatives 1, 2A, 3A), constructing artificial features, or removing existing in-stream structures (Alternatives 2B, 2C, 3B, 3C).

Most of the proposed restoration activities would involve construction within the floodplain. Changes in water elevations associated with the restoration activities would be evaluated on a project-specific basis to ensure that changes meet the requirements of the Federal Emergency Management Agency (FEMA) and King County ordinances and Executive Order 11988.

Water Quality

Short-term impacts to water quality would occur during construction from the movement and use of construction equipment at the restoration sites, and from the excavation or addition of gravels and other soils. In general, it can be anticipated that, even with erosion control under Alternatives 1, 2A, and 2C, some sediments would move off construction sites into tributaries, and some sediments would move into the mainstem under Alternatives 1, 2A, 2C, 3A, and 3C. When considered within the context of all the other activities in the basin that continue to affect Green River water quality, the small scale and short duration of potential restoration activities would result in insignificant effects to this resource.

Fisheries

The focus of the project alternatives will be to enhance fish habitat in the upper, middle, and lower basins. Alternatives 1 (No Action) and 2 (A, B, and C) would provide restorations for the wide variety of salmonids utilizing the river system. The likelihood of any increased turbidity from the construction/implementation of the restoration activities affecting salmonids is relatively minor for several reasons. First, the activities would be implemented during the prescribed in-water work windows when the potential for these species occurring in the Green River Basin would be minimal. Second, construction activities would be isolated from surface waters using construction phasing, using sediment Best Management Practices (BMPs), and minimizing the duration and extent of in-water work. Third, any turbidity increases associated with the implementation of activities would be localized and short term (generally hours). And

lastly, salmonids are tolerant of short-term exposures to high suspended sediment concentrations (Cordone and Kelly 1961; Servizi 1992; Martin et al. 1976, Reading et al. 1987).

Under Alternative 1 (No Action), beneficial changes to fish habitat would be more isolated and limited to small areas of tributaries and the mainstem, whereas under Alternative 2, the beneficial impacts would be more far-reaching, including larger areas of tributaries and the mainstem of the river. Under Alternatives 3A and 3C (single-species restoration, chinook salmon), restoration projects would focus on habitat improvements within the mainstem of the Green River, the principal use area for that species. Such activities would include creation of deep pools and installation of large cobble substrate (1-inch to 6-inch range) within the mainstem.

During construction of in-water improvements (e.g., culvert rehabilitation, flap gate repair), short-term blockages to fish passage would likely occur due to stream diversion. Impacts would be minor since the in-water work would be limited to that time period when the potential for upstream-migration of adults or downstream-migration of juveniles would be minimal (i.e., the in-water work window will be defined as a condition in the Hydraulic Project Approval issued by the Washington Department of Fish and Wildlife).

One of the benefits associated with the implementation all alternatives (Alternatives 1, 2A, 2B, 2C, 3A, 3B, 3C) would be that of providing additional habitat for aquatic invertebrates. The restoration activities likely to represent the greatest benefits would be importing sediment and LWD, creating deltaic habitat in the estuary, planting streamside vegetation, and constructing habitat features.

Threatened, Endangered, and Candidate Fish Species

All project alternatives (Alternatives 1, 2A, 2B, 2C, 3A, 3B, 3C) would result in short-term impacts associated with transport of sediment to surface waters during the construction/site stabilization process. Sediment input to surface waters can cause localized turbidity and increase sediment deposition to the streambed during construction.

Potential direct effects to chinook salmon, coho salmon, or bull trout would include:

- Sediment pulses from bed and bank disturbances have the potential to affect fish that are using the project area. However, construction will occur only during the approved in-water work windows, thereby minimizing any potential risks. Construction BMPs will also be used to minimize the potential for sediment transport. Any increases in turbidity would be localized and short term. Also, salmonids are relatively tolerant to short-term turbidity pulses. See more detailed discussion under Sections 4.7.1 - Fish Habitat and 4.7.2 - Fish Use.

- Hazardous materials associated with the proposed project will be limited to those substances associated with construction equipment, such as gasoline and diesel fuels, engine oil, and hydraulic fluids. An accidental spill of these substances could contaminate drainages, soils, wetlands, and other environmentally sensitive areas. However, the spill prevention and control plan will not allow any storage of materials or maintenance of equipment or fueling within 100 feet of the channel edge.

- Dredging has the potential to affect fish that are using the project area. However, construction will occur during the approved in-water work windows, thereby minimizing any potential risk

- Increase in habitat will occur by connecting side channels and floodplains, reconstructing channels, restoring wetlands and estuaries, and adding in-stream structure (LWD and gravel).

In the long term, the proposed alternatives and restoration activities would either maintain or improve the quality of conditions for the listed species.

Wetlands and Riparian

Impacts to wetlands under Alternatives 1 (No Action), 2A, 2B, 2C, 3A, 3B,and 3C would depend on the location and type of restoration activity. Activities could affect wetlands in two ways: during construction of restoration projects, and as an element of the restoration (i.e., restoration and connection of wetlands to the river). Subsequent NEPA environmental review would be completed for all proposed projects. Short-term impacts to riparian resources would occur during the construction phase of restoration activities. Depending on the type of restoration and location, vegetation may need to be removed for equipment to gain access to the restoration sites. In the long term, riparian vegetation would increase as a result of streamside planting.

Wildlife

During the construction phase, proposed restoration activities will temporarily impact wildlife habitat elements. These impacts will include noise from equipment and removal of vegetation to gain access to the restoration sites. In the long term, restoration activities, particularly as a part of Alternatives 1, 2A, 2C, 3A, and 3C, would result in an improvement to wildlife habitat. The activities of greatest benefit to wildlife would include importing and placing gravel and LWD, planting vegetation along tributaries and mainstem, increasing floodplain habitat and wetlands, and protecting floodplain and wetland habitat.

Threatened, Endangered, and Candidate Species

No threatened, endangered, or candidate species would be adversely affected by any of the project alternatives. Reviews of species use or potential use would be conducted as part of the site-specific environmental analyses.

Air Quality

Because of the nature of the restoration activities likely to be implemented (e.g., stream channel modifications, levee setbacks, construction of artificial spawning channels, etc.), any air quality impacts would be associated with ground clearing activities and emissions from construction equipment. Such activities would be short-term (lasting only for the duration of the clearing and/or construction period) and would have a minimal impact on overall air quality in the region. To the extent that restoration activities result in increased vegetation, air quality over the long term would improve.

Noise

Construction activities, such as the creation or enhancement of habitat, installation of LWD and gravel and cobble, or construction of weirs, would generate short-term noise impacts due to the use of heavy equipment. Noise impacts would depend on the nature and location of the activity, the surrounding land uses, the number of sensitive noise receptors (e.g., residences) in the immediate vicinity of the project, and the types of equipment used.

Transportation

Implementation of any of the project alternatives and subsequent construction would require the movement of equipment and materials along existing roadways within the Green River Basin. The impact on roadways and traffic will depend on the location and type of the restoration activities.

Access to proposed restoration sites will vary from site to site. Construction of temporary access roads, of variable length, may be required in some cases.

Land and Shoreline Use

Under all alternatives, general land use patterns and aesthetic qualities should not be adversely affected under any alternative. Land ownership may be affected if direct land purchase is required; however this should not affect the overall balance of ownership patterns within the basin. Land management practices would not be affected since the pertinent local plans and ordinances, as well as state planning regulations, encourage the preservation and restoration of the basin's vital natural resources.

Recreation

During construction, there could be temporary and localized increases in noise, dust, and construction-related traffic, including detours. These conditions may temporarily decrease the quality of the recreational experience at the recreational facilities near the active construction areas. Construction impacts on recreational facilities or areas in the vicinity would be minor, short-term, and evaluated during the environmental review of each specific restoration project.

The greatest potential for recreational impact exists with the placement of LWD within the river and tributaries (Alternatives 1, 2A, 2C, 3A, 3C). LWD and recreational boating was an issue raised during scoping. The popularity of boating and floating recreation within the basin necessitates that individual restoration project environmental reviews address the placement and visibility of LWD in-river to reduce the potential for injury to recreationalists or damage to their equipment. Guidance for such placement would be derived from the LWD and recreation study conducted by King County.

Visual Quality and Aesthetics

Construction activities and equipment would generally be visible in the immediate vicinity of urban developments and recreational facilities/areas. From greater distances, soil disturbances and road cuts would contrast with areas that remain vegetated in the less developed portions of

the basin (e.g., the middle basin and the upper basin). In the long term, aesthetic quality along portions of the river would improve with a more natural appearance through the revegetation, levee setbacks, and implementation of side channel, culvert replacement, and other restoration improvements.

Environmental Justice

There would no adverse impacts of the alternatives regarding environmental justice.

Public Services and Utilities

Specific short-term impacts from construction activities (lasting only the duration of the construction period) should be minor and localized, and will be analyzed and mitigated under the project-specific environmental review process.

Cultural and Historic Resources

Evaluation of project-specific impacts would occur as part of the environmental review for individual restoration projects.

Under all alternatives, short-term impacts to cultural resources resulting from the proposed restoration activities could occur during construction, from movement and use of construction equipment at the restoration sites. The level of impact would vary depending on factors such as the extent of previous disturbance, the age of the affected sediments, and the action planned.

Long-term impacts to cultural resources would be associated with the ongoing functioning of the restoration activities. The majority of the proposed restoration activities are designed to modify stream morphology as described in Section 4.4. Changes in channel position and morphology, either intended or as an unexpected consequence of habitat improvements, have the potential to affect sub-surface archaeological material, possibly historical structures or buildings, or important characteristics of traditional cultural properties.

Mitigation Measures

The need for mitigation measures to minimize impacts relates primarily to the short-term impacts of construction. The following mitigation measures will be implemented for the proposed project:

- Procedures and Best Management Practices (BMPs) will be developed for flagging sensitive areas (e.g., wetlands, sensitive plants, cultural resources, etc.) and utilities off-limits to construction, operation of heavy equipment at restoration sites to minimize impacts of soil compaction, stream crossings, construction access roads and staging areas, stockpiling of soil and construction materials, sanitation, and excavation, and maintenance of equipment (i.e., refueling, etc.).

- As a part of the project-specific evaluation process, site-specific surveys and environmental analyses will be conducted to locate sensitive wildlife species.

- Monitoring will be performed following project completion to ensure that restoration activities implemented at individual sites do not create long-term unintended consequences to fish, wildlife, and plant species, or their critical habitats, or adversely affect stream morphology or stream banks in the vicinity of the projects, or create unintended consequences for cultural and historic resources in the vicinity of the projects.

- Mitigation measures for the cultural resources would include conducting cultural resources studies as early as possible in project design to avoid late discovery of cultural or historical properties that could delay implementation of a project, and to implement the stipulations set forth in the draft MOA (Appendix E).

- Guidance developed by the USFWS (unpub.) and WDFW (1998) will be utilized for the design and construction of restoration features.

- The following BMPs will be utilized for air quality: (1) Water all excavated or graded areas, (2) minimize the total construction area disturbed by clearing, earth moving, or excavation, (3) sweep paved streets adjacent to the project site at least once per day to remove silt accumulated from construction activities, and (4) maintain all construction vehicle internal combustion engines according to manufacturer specifications.

- The following BMPs will be utilized for noise: (1) Restrict construction activities within 1,000 feet of residences to daytime hours, and do not perform construction within 1,000 feet of an occupied dwelling on legal holidays, or between 10 p.m. and 7 a.m. on other days; (2) use noise control devices no less effective than those provided on the original equipment; and (3) place stationary noise-generating equipment as far away from existing businesses and buildings as is reasonably possible.

- A transportation plan will be developed for proposed restoration sites. The plan will include access considerations, scheduling, traffic control and specific transportation and traffic measures required by permits.

- All regulatory permits, official project authorizations, and compliance with federal, state, and local regulations and ordinances (e.g., National Environmental Policy Act, National Historic Preservation Act, Level I Contaminants Survey, etc.) will be secured before project implementation.

- For projects that include placing LWD in the mainstem channel, coordination with recreational boat clubs will occur by posting LWD locations on a Web page for recreational boaters.

- A fire and emergency response plan will be developed to include communications, locations of water truck and/or chemical fire suppression materials.

Cumulative Impacts

Individual projects would range in size from fractions of an acre to tens of acres. Relatively minor impacts that might occur at individual restoration sites could occur over a relatively large area when all individual projects are considered together.

However, when examined within the broad geographic extent of the project area, adverse impacts of each project would be localized and relatively minor. Overall, restoration activities throughout the Green/Duwamish River Basin would provide a net benefit to water quality, fish, and fish habitat, and other natural resources such as vegetation and wildlife. Other impacts, as described in this section, would affect only a small portion of lands available for such uses within the Green/Duwamish River Basin.

Impacts from implementing restoration projects throughout the Green/Duwamish River Basin would add to past, present, and future impacts occurring from other human activities in the region. Development, industry, navigation, and water control projects have resulted in long-term degraded conditions throughout most of the basin. Negative effects of restoration projects are temporary and associated only with project implementation. Negative effects are compensated by overall improvements in watershed condition, and, ultimately, increases in fish and wildlife habitats and populations.

The proposed restoration program would have beneficial cumulative effects with other habitat conservation enhancement projects, and would incrementally offset adverse impacts on habitat and related natural resources from past, present, and future development projects.

Restoration projects are designed to restore or enhance lost or degraded habitat functions, to reduce the fragmentation of habitat areas, and to restore ecological functions at individual sites within the Green River Basin that cumulatively would provide a significant benefit to the resource.

Coordination and Compliance

Extensive coordination has already been accomplished during the initial phases of the study. Primarily, this is done through two separate mechanisms. The first is, the Green River Forum (composed of managers from cities throughout the Green River Basin) has acted as an executive committee. They review and comment on policy actions related to the Ecosystem Restoration Study. Secondly, a technical committee comprised of representatives of Washington State Department of Fish and Wildlife, U.S. Fish and Wildlife Service, King County, Cities of the Green River Valley, the Corps and Muckleshoot Indian Tribe was established for providing oversight on proposed restoration activities. Numerous public meeting were also conducted throughout the project area to provide information on the Study as well as obtain citizen input. In addition, when conducting such actions as the Ecosystem Restoration Study, the Corps is required to coordinate with the U.S. Fish and Wildlife Service under the Fish and Wildlife Coordination Act. Specific reports that provide the Service's opinion on the proposal and recommendations are included in a Planning Aid Letter and a Coordination Act Report.

There are many federal, state, tribal, and local laws, regulations, and treaties potentially applicable to the Green River restoration activities.

To construct a restoration project, various permits may be required from local state and federal agencies. Public hearings may also be required. Some environmental permits are joint permits; an example is the Washington Joint Aquatic Resource Permit for Hydraulic Project Approval, Shoreline Substantial Development Permit, Floodplain Management Permits and/or Critical

Areas Ordinances, Section 401 Water Quality Certification, Approval to Allow Temporary Exceedance of Water Quality Standards, and Section 10 and Section 404 Permits from the Corps of Engineers. In-water projects require review by several resource agencies. Restoration work may also require compliance with various construction codes and health and safety and labor laws.

Monitoring to ensure that restoration projects minimize, avoid, or compensate for environmental impacts would occur. The Corps has defined monitoring program as an element of the proposed restoration plan. Please see section 10 of Volume II for a discussion of monitoring.

Monitoring may also be required for projects involving conditions associated with Section 404 permit approval. Site monitoring can be assisted by public stewardship of some restoration projects.

Overview of Volume II – Restoration Plan

The Restoration Plan provides a framework for implementing the Preferred Alternative (a program to restore ecological resources and processes that benefit multiple fish, riparian, and riverine-associated wildlife species). If the Preferred Alternative is ultimately selected, the Restoration Plan will become the final and operative plan for the Green/Duwamish River restoration activities.